

## **CLAIMS**

- 1 A system for treating wastewater comprising at least one reactor comprising
  - a) at least a first tank interconnected to a second tank for retaining wastewater therein and discharging treated wastewater therefrom, said tanks provided with means for influence and means for effluence to allow fluid level within at least one tank to be fillable to a filled level and emptied to a lower discharged level;
  - b) independently controllable first and second means for stage generation provided for each said first and second tank respectively;
  - c) carriers for growth of biomass provided in each of said tanks; and
  - d) a controller for controlling the operation of said first means for stage generation to create a first condition for the selective growth of a first biomass on said carriers within said first tank to form a first sludge, said first sludge adapted for performing a first bioreaction stage in said wastewater; and said controller further adapted for controlling the operation of said second means for stage generation to create a second condition for the selective growth of a second biomass on said carriers within said second tank to form a second sludge, said second sludge adapted for performing a second bioreaction stage in said wastewater.
- 2 The system according to claim 1 wherein said first and second means for stage generation comprise at least a mixer, aerator, heater, cooler, pump or a combination thereof.
- 3 The system according to claim 1 wherein said first and second tanks are disposed some vertical distance from each other, and said means for stage generation comprising interconnections for fluid flow between said first and second tanks.
- 4 The system according to claim 1 wherein said first tank and said second tank are interconnected via openings in a separation wall therebetween.
- 5 The system according to claim 1 wherein said reactor further comprises a third tank and recycling means for connecting said first and second tank thereto, said

recycling means adapted for transferring mixed liquor from said first or second tank into said third tank for generation of a third bioreaction stage.

- 6 The system according to claim 5 wherein said third tank is further provided with a third means for stage generation; said controller further adapted to control said third means for stage generation such that a user may create a third condition for the selective growth of a third biomass to form a third sludge.
- 7 The system according to claim 6 wherein said third means for stage generation comprises at least a mixer, aerator, heater, cooler, pump or a combination thereof.
- 8 The system according to claim 5 further comprising a fourth tank provided with recirculating means for receiving mixed liquor from said reactor for further generation of a fourth bioreaction stage.
- 9 The system according to claim 8 wherein said fourth tank is further provided with a fourth means for stage generation; said controller further adapted to control said fourth means for stage generation such that a user may create a fourth condition for the selective growth of a fourth biomass to form a fourth sludge.
- 10 The system according to claim 9 wherein said fourth means for stage generation comprises at least a mixer, aerator, heater, cooler, pump or a combination thereof.
- 11 The system according to claim 1 wherein said reactor further comprises a bioselector connected to the first or second tank for selection of the desired micro-organisms.
- 12 The system according to claim 1 wherein said first sludge is adapted for performing removal of carbon, solids, nitrogen or phosphorus.
- 13 The system according to claim 1 wherein said second sludge is adapted for performing removal of carbon, solids, nitrogen or phosphorus.
- 14 The system according to claim 5 wherein said third sludge is adapted for performing removal of carbon, solids, nitrogen or phosphorus.
- 15 The system according to claim 8 wherein said fourth sludge is adapted for performing removal of carbon, solids, nitrogen or phosphorus.

- 16 The system according to claim 1 wherein said first condition is selected from a group consisting of anaerobic condition, aerobic condition or anoxic condition.
- 17 The system according to claim 1 wherein said second condition is selected from a group consisting of anaerobic condition, aerobic condition or anoxic condition..
- 18 The system according to claim 5 wherein said third condition is selected from a group consisting of anaerobic condition, aerobic condition or anoxic condition.
- 19 The system according to claim 8 wherein said fourth condition is selected from a group consisting of anaerobic condition, aerobic condition or anoxic condition.
- 20 The system according to claim 1 wherein a partition is further provided to divide said first tank into two hydraulically connected sub-tanks.
- 21 A method of treating wastewater using at least one reactor containing at least a first tank and a second tank, said tanks provided with carriers for growth of biomass thereon, said method comprising
  - a) dispensing wastewater into said first and second tanks;
  - b) controlling the operating conditions of the tanks separately such that a first condition is created for growth of a first biomass on said carriers as a first sludge suitable for a first bioreaction stage within the first tank, and a second condition is created for growth of a second biomass on said carriers as a second sludge suitable for a second bioreaction stage within the second tank; and
  - c) emptying said wastewater in at least one tank after treatment therein.

- 22 The method according to claim 21 wherein said first sludge is adapted for performing removal of carbon, solids, nitrogen or phosphorus.
- 23 The method according to claim 21 wherein said second sludge is adapted for performing removal of carbon, solids, nitrogen or phosphorus.
- 24 The method according to claim 21 wherein said first condition is selected from a group consisting of anaerobic condition, aerobic condition or anoxic condition.
- 25 The method according to claim 21 wherein said second condition is selected from a group consisting of anaerobic condition, aerobic condition or anoxic condition.
- 26 The method according to claim 21 wherein said first sludge and second sludge attached on said carriers are denser than the wastewater used for treatment thereof; and said first and second conditions are produced by intermittent aeration of said carriers in said first and second tanks.
- 27 The method according to claim 21 wherein said reactor further comprising a third tank, and said method further comprises transferring mixed liquor from said first or second tank into said third tank for development of a third sludge for a third bioreaction stage.
- 28 The method according to claim 21 wherein said a fourth tank is further provided, and said method further comprises transferring mixed liquor generated after bioreaction in said reactor into said fourth tank for development of a fourth sludge for a fourth bioreaction stage.
- 29 The method according to claim 27 wherein said third sludge comprises an activated sludge suspension, said method further comprises the step of stimulating said third sludge to remove phosphorus from said wastewater through stressing the biomass of said third sludge by cycling said mixed liquor through the first and second bioreaction stages.